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Surface Roughness Scaling of Beryllium Thin Films

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Atomic force microscopy data reveal self-affine scaling of sputter-deposited Be films. For films less than 1 μm thick, the rms surface roughness σ increases with film thickness τ as $\sigma(f<\xi^{-1}) \sim \tau^{\beta}$, and with measurement length L as $\sigma(f>L^{-1}>\xi^{-1}) \sim L^{\alpha}$, where ξ is the surface roughness correlation length and f is the spatial frequency of the surface roughness. For this thin film regime, $\beta \sim 0.5$ and $\alpha \sim 1.4$. For films between 1 and 5 μm thick, we see evidence of the emergence of a second correlation length and scaling exponent α, indicating a scaling crossover from thin to thick film behavior.

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